



4304/2544



4304/2544



INVESTOR IN PEOPLE

The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

REC'D 13 JUL 2004
WIPO PCT

PRIORITY DOCUMENT

SUBMITTED OR TRANSMITTED IN
COMPLIANCE WITH RULE 17.1(a) OR (b)

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

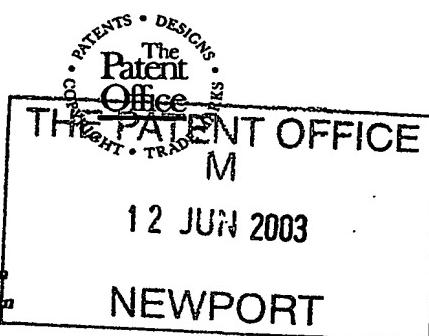
Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

Signed

Dated

R. McChoney
29 June 2004

BEST AVAILABLE COPY

12 JUN 03 E814363-1 D00239
P01/7700 0.00-0313521.7

The Patent Office

Cardiff Road
Newport
South Wales
NP10 8QQ**Request for grant of a patent**

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

1. Your reference JTS\P12953GB

0313521.7

2. Patent application number
(The Patent Office will fill in this part) 12 JUN 2003

3. Full name, address and postcode of the or of each applicant (underline all surnames)

Axiom Process Limited
Central Square South
Orchard Street
Newcastle Upon-Tyne
NE1 3XX

Patents ADP number (if you know it)

85d 565001

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention Screening Apparatus

5. Name of your agent (if you have one)

Cruikshank & Fairweather

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

19 Royal Exchange Square
Glasgow, G1 3AE
Scotland, UK

Patents ADP number (if you know it)

547002

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number
(if you know it)Date of filing
(day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing
(day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

No

- a) any applicant named in part 3 is not an inventor, or
 - b) there is an inventor who is not named as an applicant, or
 - c) any named applicant is a corporate body.
- See note (d))*

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form.
Do not count copies of the same document

Continuation sheets of this form -
Description 9

Claim(s) -

Abstract -

Drawing(s) 3 + 3 /

10. If you are also filing any of the following, state how many against each item.

Priority documents -

Translations of priority documents -

Statement of inventorship and right to grant of a patent (*Patents Form 7/77*) -

Request for preliminary examination and search (*Patents Form 9/77*) -

Request for substantive examination
(*Patents Form 10/77*) -

Any other documents
(please specify) -

I/We request the grant of a patent on the basis of this application.

C. Szczuka & Son Ltd
Signature

Date

11 June 2003

12. Name and daytime telephone number of person to contact in the United Kingdom Mr Jan T Szczuka - 0131 225 4500

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

- a) If you need help to fill in this form or you have any questions, please contact the Patent Office on 08459 500505.
- b) Write your answers in capital letters using black ink or you may type them.
- c) If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.
- d) If you have answered 'Yes' Patents Form 7/77 will need to be filed.
- e) Once you have filled in the form you must remember to sign and date it.
- f) For details of the fee and ways to pay please contact the Patent Office.

-1-

SCREENING APPARATUS

The present invention relates to vibratory screening apparatus suitable for use with drilling fluids and the like.

5

Vibratory screening apparatus is widely used in the oil drilling industry for removing drill cuttings from drilling fluids, and over the years various improvements have been made to the screens used therein, methods for mounting the screens etc to improve ease of use, reduce maintenance etc. A particular problem in offshore platform oil drilling is, however, that platform real estate is very restricted and extremely expensive. There is accordingly a need to improve the efficiency of vibratory screening apparatus in relation to 15 the physical size thereof.

The present invention provides a vibratory screening apparatus for use in removing solids from a liquid and solids mixture feed, said apparatus comprising a static outer housing, at least one floating basket mounted so as to be vibratable, in use of the apparatus, by a vibrator device formed and arranged for vibrating said basket, said basket mounting a stack of screen assemblies separated by flow directing trays, said apparatus being provided with a flow distributor formed and arranged for dividing said feed into at least a first feed stream and a second feed stream and directing said feed streams 25

onto respective ones of first and second screen assemblies, and receiving from respective flow directing trays, respective filtrates from said respective screen assemblies.

5 With an apparatus of the present invention, the size of apparatus required to process a given volume of feed is substantially reduced compared with conventional apparatus, since a substantially increased effective screen surface area can be accommodated with relatively little or no increase in
10 10 the size of the apparatus by means of stacking a plurality of screen assemblies within a single basket.

Advantageously the distributor is formed and arranged so as to be switchable between a plurality of different flow directing
15 configurations. Conveniently said plurality of flow directing configurations includes an intensive screening configuration in which the whole of the feed is directed onto said first screen assembly and the whole of the filtrate from said first screen assembly is directed onto said second screen assembly.

20 Alternatively or additionally there is provided a restricted feed capacity configuration in which the whole of the feed is directed onto only one of said first and second screen assemblies, and the filtrate therefrom exhausted directly from the apparatus without passing through the other one said first
25 and second screen assemblies. Such a configuration is useful for basic fluid processing where high efficiency or high volume

-3-

processing are not required and a reduced number of screens in operation reduces operating cost for screens consumed.

Advantageously the mesh sizes of the various screens are

5 selected to suit the particular distributor configuration being employed and/or the loading of the mixture (% solids content), the particle size of the solids, and/or the particle size distribution of the solids. Thus for example in a configuration where the feed is divided into one portion
10 passing through the first screen and not the second, and another portion passing through the second screen and not the first, the first and second screens would normally have the same mesh size. On the other hand in a configuration where the whole of the feed is passed successively through both the first
15 and second screens, then the second screen would normally have a finer mesh size than the first screen.

In general the distributor will comprise a plurality of passages provided with valves, typically flap valves, sleeve

20 valves or plug valves, for selective opening or closing of different passages. The distributor may be mounted in either the static housing or on the floating basket. It is also possible, in principle, for part of the distributor to be mounted in the static housing and part on the floating basket.
25 Where a greater or lesser part of the distributor is mounted in the static housing, then the distributor is generally provided

with flexible conduit portions defining at least part of the passages, for coupling the passages from the static housing to the floating basket.

- 5 The passages of the distributor may be defined in various different ways. Conveniently they are defined by walls extending downwardly inside a downwardly extending chamber so as to provide a lateral subdivision of the chamber into individual passages providing predetermined proportions of the distributor flow capacity. Thus, for example, the distributor may be formed and arranged with one or more first flow passages for transmitting said first feed stream, and one or more second flow passages for transmitting said second feed stream.
- 15 It is generally preferred that vibratory screen apparatus should have a plurality of screen assembly stages with decreasing mesh size. It will accordingly be appreciated that in addition to having first and second screen assemblies, with similar mesh size, formed and arranged for intercepting said first and second feed streams respectively, the vibratory basket may also have one or more further screen assemblies with different mesh size upstream and/or downstream of said first and second screen assemblies. Conveniently there is provided upstream of first and second screen assemblies, an initial, 20 coarser mesh size, screen assembly and the vibratory screening apparatus is formed and arranged so that substantially the
- 25

-5-

whole of the liquid and solids mixture feed is directed through said initial screen assembly, before being divided into said at least first and second feed streams. In such cases there would generally be used an initial screen assembly with a mesh size 5 of around 10 to 80 (wires per inch), for example, about 20, and the first and second screen assemblies would have a mesh size of around 40 to 325, conveniently 100 to 250 for example about 200. In yet another possible distributor configuration which could also be provided, the feed is passed only through the 10 initial coarse screen.

Various screen assemblies and screen mounting systems may be used in the apparatus and baskets of the present invention, including, for example, those described in our earlier patent 15 publication WO 03/013690.

In a further aspect the present invention provides a basket suitable for use in a vibratory screening apparatus, said basket mounting a stack of screen assemblies separated by flow 20 directing trays, and being provided with a flow distributor formed and arranged for dividing said feed into at least a first feed stream and a second feed stream and directing said feed streams onto respective ones of first and second screen assemblies, and receiving from respective flow directing trays, 25 respective filtrates from said respective screen assemblies.

Further preferred features and advantages of the invention will appear from the following detailed description given by way of example of preferred embodiments illustrated with reference to the accompanying drawings in which:

- 5 Fig. 1 is a schematic sectional elevation of a vibratory screening apparatus of the present invention;

Fig. 2

Fig. 1 shows schematically one embodiment of a vibratory screen apparatus 1 of the invention with an outer housing 2 in which is mounted on springs 3 a basket 4. The basket is generally box shaped with pairs of circumferentially extending inwardly projecting flanges 5 height on the basket side walls 6, for supporting respective ones of a stack 7 of screen assemblies 8 separated by flow directing trays 9. A vibrator unit 10 is secured to the top 11 of the basket. The interior 12 of the basket 4 is divided into a series of levels 13 between neighbouring screen assemblies 8 and flow directing trays 9.

20 Figs. 2 A/B to 4 A/B show schematically a distributor 15 provided at one end 16 of the floating basket 4. The distributor 15 is formed and arranged into inside and outside passages 17, 18 shown in Figs. 2A to 4A, and 2B to 4B, respectively, for connecting with the various levels 13 of the interior 12 of the basket 4 via openings 19 controlled by flap valves 20. In some cases the flap valves 20 are additionally

used to control openings 21 along the length of the passages 17, 18 in certain positions of said flap valves 20, as further described hereinbelow.

- 5 Figs 2A/B, 3A/B and 4A/B show different configurations of the distributor 15 for providing different feed flow arrangements through the screen assemblies 8, which are indicated as A, B and C, respectively, in Figs 2 to 5.
- 10 In more detail Fig 2A shows the inside passage 17 and interior 12 of the basket 14, with an upper flap valve 20' raised to open an upper connecting opening 19' connecting the passage 17 and first level 13¹ above the upper flow deflector tray 9'. An intermediate flap valve 20'' is raised to close an intermediate 15 connecting opening 19'' connecting the passage 17 and second level 13² between the upper and lower flow deflector trays 9', 9'' whilst simultaneously opening an intermediate level opening 21' in passage 17. A lower flap valve 20''' is lowered to open a lower connecting opening 19''' connecting the passage 17 and 20 a fourth level 13⁴ below the lower flow deflector tray 9''. In this configuration it may be seen that a feed 22 of liquid and solids is passed through a coarse mesh, (typically mesh size 20) upper screen 8' and the filtrate 23 passed along the upper flow deflector tray 9' into passage 17 and thence, bypassing a 25 first, mid-level, screen 8'', onto a second, low-level, screen 8'''. In this configuration the whole of the feed 22 is passed

through the coarse screen 8' and only one of the first and second screens 8'', 8'''.

Figs. 3B shows the distributor 15 configured so that the upper flap valve 20' is raised to open the upper connecting opening 19', the intermediate flap valve 20'' is lowered to open the intermediate connecting opening 19'' whilst simultaneously closing the intermediate level passage opening 21', and the lower flap 20''' is lowered to open the lower connecting opening 19''' whilst closing a bottom passage opening 21'' as before. In this configuration the whole of the feed 22 is passed through the coarse screen 8' and then successively through each of the first and second screens 8'', 8''' thereby providing a more progressively finer screening of the feed (by 15 using a finer mesh size in the second screen than in the first screen).

Fig. 4A shows the distributor in the inside passage 17 configured so that the upper flap valve 20' is raised as before. The intermediate flap valve 20'' is lowered so as to open the intermediate connecting opening 19'' whilst simultaneously closing the intermediate level passage opening 21' and the lower flap 20''' is raised to close the lower connecting opening 19''' whilst opening the bottom passage 25 opening 21'''. In this configuration of the inside passage 17 in the distributor 15, that part 23' of the filtrate 23 from

-9-

the coarse screen 8' passing into the inside passage 17, is directed onto the first screen 8'' and then out of the bottom opening 21'' of the inside passage 17, by-passing the second screen 8''''. The outside passage 18 is configured as in Fig.

- 5 2A so that the remaining part 23'' of the filtrate 23 from the coarse screen 8' passing into the outside passage 18, is directed onto the second screen 8''' by-passing the first screen 8''. It will be appreciated that in this configuration of the distributor 15, the screen area available for screening 10 of the feed 22 is effectively double that used in Fig. 2A/B and that available in a conventional vibratory screening apparatus basket of similar footprint.

Figs. 5A - C are schematic respective views of the end 16 of 15 the basket 4 to which the distributor 15 is coupled but with the distributor 15 substantially removed for clarity, showing the flows in and out of the various openings 19 connecting the distributor 15 to the interior 12 of the basket 4.

- 20 Fig. 6 shows schematically another embodiment in which there is used a distributor 24 mounted on the static housing 2 and with its connecting openings 19 coupled to the corresponding levels 25 inside the floating basket 4 by flexible conduits 26.

1/3

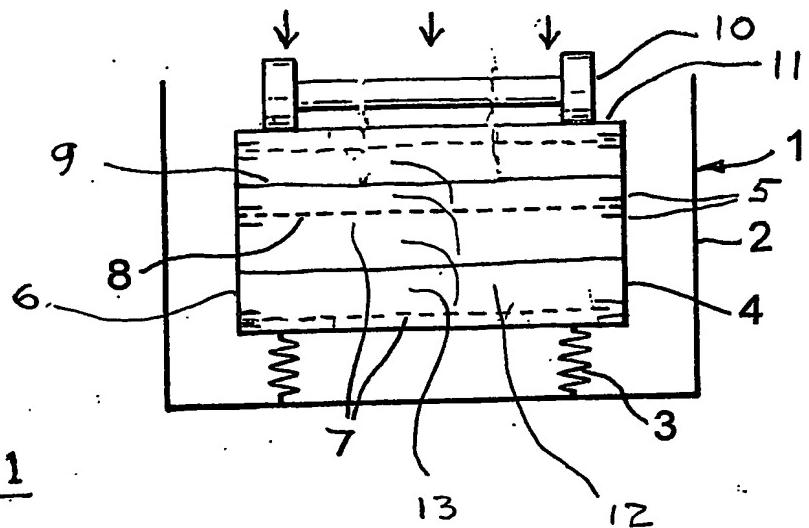


FIG. 1

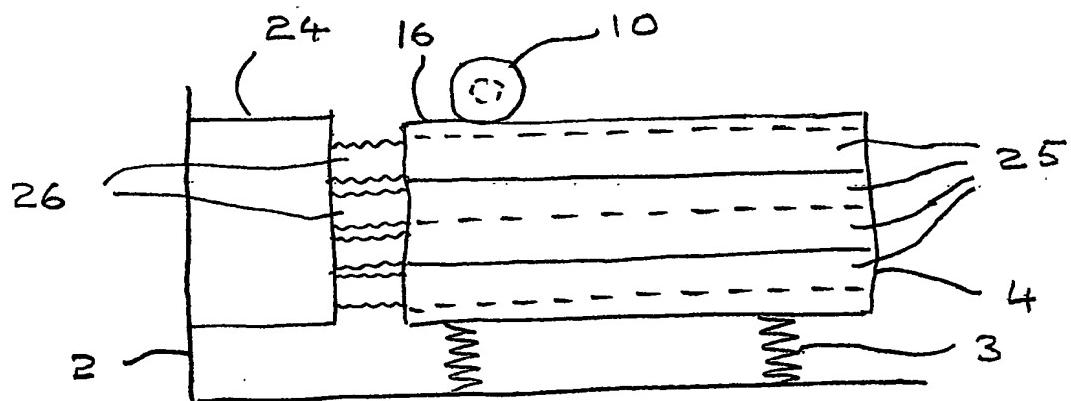


FIG. 6

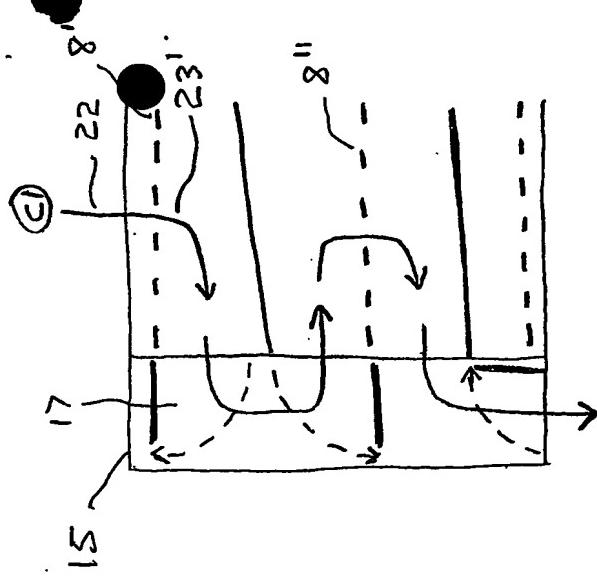


FIG. 2A

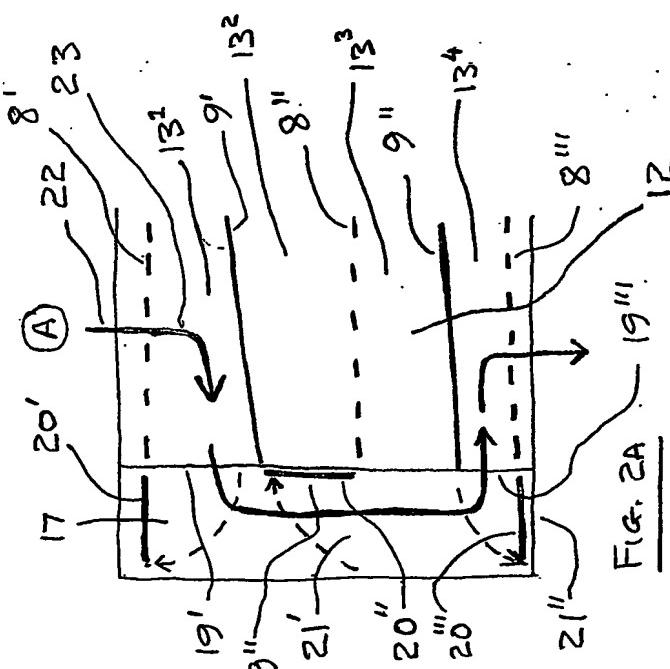


FIG. 2B

2 / 3

FIG. 4A

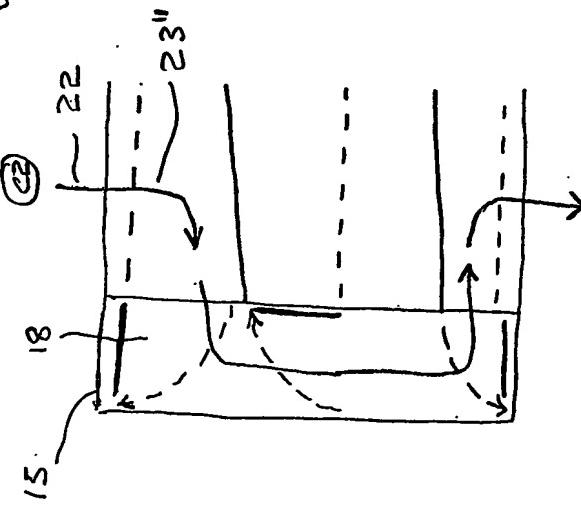


FIG. 4B

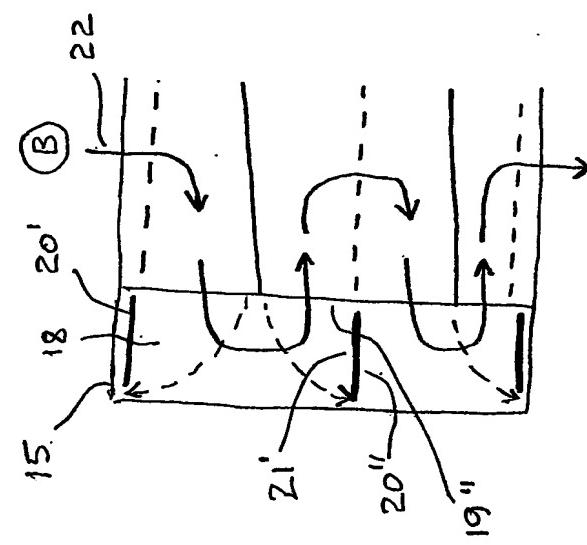


FIG. 3B

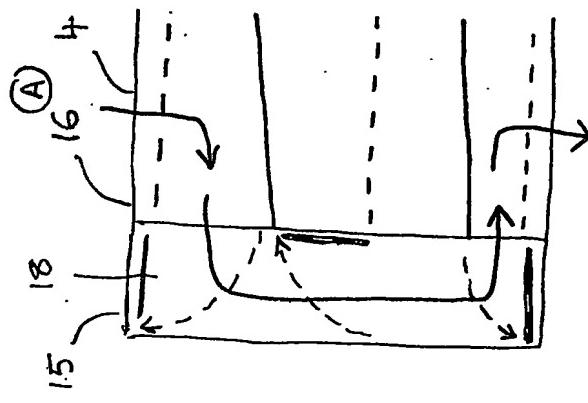


FIG. 2B